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BOOSTER HEATER

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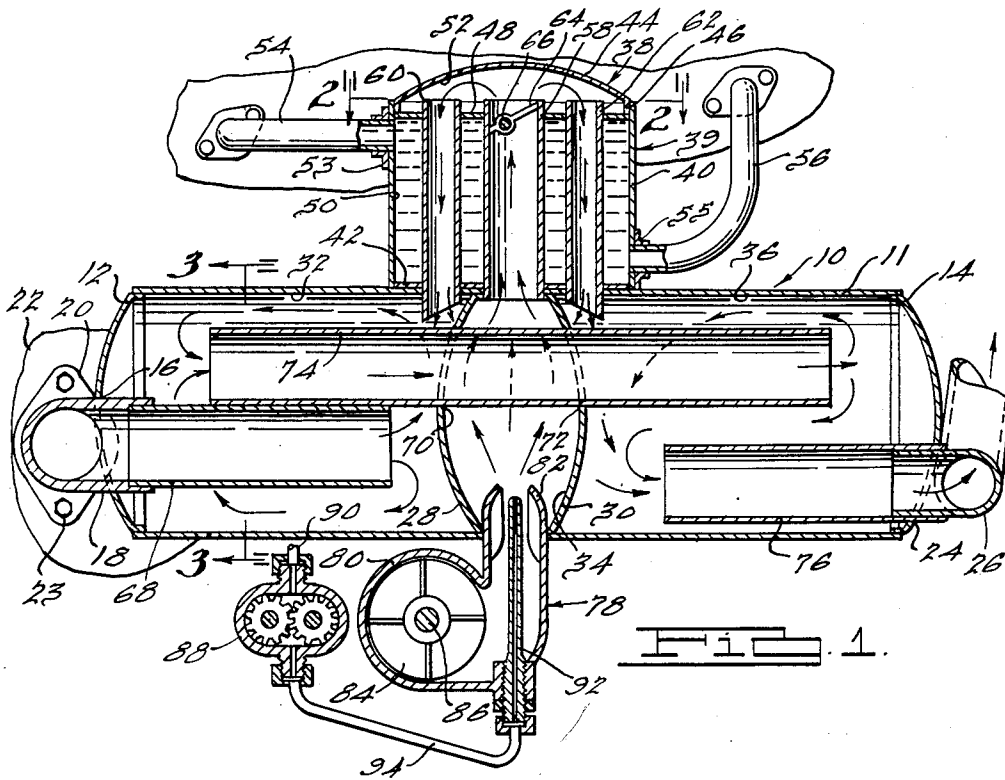


FIG. 1.

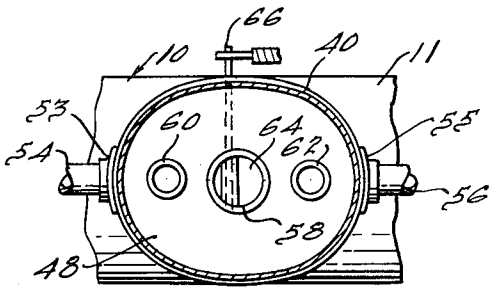


FIG. 2.

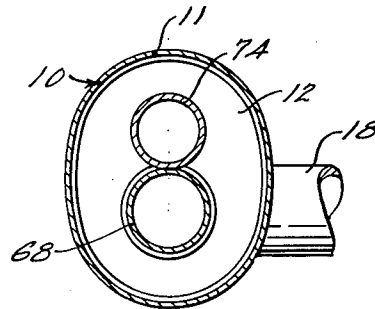


FIG. 3.

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BOOSTER HEATER

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7 Claims. (Cl. 123-142.5)

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2

This invention relates to heaters and more particularly to an improved booster heater adapted for use in heating the coolant of liquid cooled internal combustion engines, particularly diesel engines.

Heretofore, it has been difficult to start internal combustion engines in cold climates after the engines have been turned off and allowed to cool to a low temperature because the components of the engine shrink and fit relatively closely, thereby increasing the frictional forces in the engine. In addition, the decrease in the viscosity of the engine lubricants at low temperatures necessitates the application of increased starting torque which frequently is greater than that which the starter is capable of generating. Furthermore, the starting of diesel engines is particularly difficult because of the inability to obtain sufficient pressure during the compression stroke of the engine with the result that the fuel fails to ignite.

Accordingly, an object of the invention is to provide an improved booster heater for internal combustion engines which facilitates starting such engines when the ambient atmosphere is at a relatively low temperature.

Another object of the invention is to provide an improved booster heater for internal combustion engines that is compact, economical to manufacture and assemble, light in weight, durable, efficient and reliable in operation.

Another object of the invention is to provide an improved booster heater of the indicated character that functions to efficiently heat the coolant of the engine thereby maintaining the lubricants and the components of the engine at a relatively warm temperature, and also functions as a muffler for the exhaust gases of the engine when the engine is in operation.

Still another object of the invention is to provide an improved booster heater having a maximum of heat transfer area in the region of greatest heat flow, thereby increasing the rate of heat transfer and the thermal efficiency of the unit and reducing the weight and cost of the material forming the unit to a minimum.

The above as well as other objects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawing wherein:

Figure 1 is a side elevational view, with portions in section, of a booster heater constructed in accordance with the present invention;

Fig. 2 is a sectional view of the structure shown in Fig. 1, taken on the line 2-2 thereof; and

Fig. 3 is a sectional view of the structure shown in Fig. 1, taken on the line 3-3 thereof.

Referring to the drawing, an elongated tubular

body, generally designated 10, is provided, which may be formed from sheet metal or other suitable material. The wall 11 of the tubular body 10 is preferably of elliptical cross sectional contour, as shown in Fig. 3, and end caps 12 and 14 are brazed, welded or otherwise fixed to the end portions of the body 10 so as to seal the ends thereof. The cap 12 is provided with an aperture 16 adapted to accommodate one end portion of an exhaust pipe 18 while the opposite end portion of the exhaust pipe is shown as provided with an integral flange 20 which facilitates connecting the exhaust pipe to the engine manifold 22 by bolts 23. The end cap 14 is apertured, as at 24, to accommodate one end portion of a tail pipe 26 while the distal end of the tail pipe 26 is open to the atmosphere.

For the purpose of partitioning the tubular body 10 into a plurality of chambers, a pair of spaced, curved, transversely extending plates 28 and 30 are provided, the edge portions of which are fixed to the inner surface of the wall 11, as by welding or the like, and divide the tubular body 10 into chambers 32, 34 and 36.

A heat exchange unit, generally designated 38, projects outwardly from the upper portion of the body 10, as viewed in Fig. 1, and is comprised of a water tank 39 having a side wall 40 shaped in the form of an ellipse, the minor diameter of which is substantially the same as the minor diameter of the body 10, and a bottom wall 42 shaped to complement and fit the wall 11 of the tubular member 10. The bottom wall 42 is fixed to the wall 11 and the upper end portion of the tank is closed by a closure member 44, the marginal portion of which is provided with a depending flange 46 which snugly fits the side wall 40 of the tank. A plate 48 extends across the upper portion of the tank 39 and partitions the tank into watertight chambers 50 and 52. The upper portion of the chamber 50 is provided with a fitting 53 adapted to receive one end of a hose 54 which connects the upper portion of the chamber 50 to the cooling system of the engine while the lower portion of the chamber 50 is provided with a fitting 55 adapted to receive one end of a hose 56 which connects the lower portion of the chamber to the cooling system of the engine.

A centrally disposed tube 58 is mounted in the tank 39, the upper end portion of the tube 58 projecting through an aperture in the plate 48 into the chamber 52 while the lower end portion of the tube 58 projects through aligned apertures in the bottom wall 42 and the outer wall 11 of the tubular member 10 into the upper portion of the chamber 34, which functions as a combustion chamber for fuel, as will be described

hereinafter in greater detail. A pair of tubes 60 and 62 are disposed in the tank 39 on opposite sides of the tube 58, the lower end portions of the tubes 60 and 62 projecting into the chambers 32 and 36, respectively, while the upper end portions of the tubes project through the plate 48 into the chamber 52.

An unbalanced plate valve 64, mounted on a weighted pivot pin 66, is disposed in the upper end portion of the tube 58 and functions to prevent engine exhaust gases from passing into the combustion chamber 34 when the engine is operating. The valve 64 is balanced so as to open when the pressure in the combustion chamber 34 exceeds the pressure in the chamber 52 and to close when the pressure in chamber 52 exceeds the pressure in the combustion chamber 34.

The outer end portion of a tube 68 is fitted in the inner end portion of the exhaust pipe 18 while the inner end portion of the tube 68 projects into the chamber 32 and terminates at a position near, but spaced from, the plate 28. The plates 28 and 36 are provided with aligned apertures 70 and 72 adapted to accommodate and snugly fit a longitudinally extending pipe 74 which projects through the chamber 34, one end portion of the pipe 74 terminating in the chamber 32 at a position outwardly spaced from the inner end of the pipe 68 while the opposite end of the pipe 74 terminates in the chamber 36 at a position outwardly spaced from the inner end of a tube 76. The tube 76 extends into the chamber 36 and the inner end thereof terminates at a position near, but spaced from, the plate 30 while the outer end portion of the tube 76 is connected to the tail pipe 26.

In order that fuel may be burned in the combustion chamber 34, a gun-type oil burner, generally designated 78, is provided and includes a housing 80 having a nozzle portion 82 projecting into the combustion chamber 34 through an aperture in the wall 11 of the tubular member 10. A blower 84 is mounted in the housing 80 on a shaft 86 which may be driven by any suitable means, such as an electric motor (not shown), the blower functioning to force air into the combustion chamber 34 through the nozzle portion 82 to support the combustion of the fuel. A gear pump 88 of conventional design is also provided, the inlet side of the gear pump being connected to a suitable fuel reservoir (not shown) by a fuel line 90 while the outlet side of the pump is connected to a nozzle 92 by a fuel line 94, the end of the nozzle 92 terminating adjacent the throat of the nozzle portion 82 of the housing 80. Any desired or well known means may be provided for igniting the fuel in the combustion chamber, as for example, a conventional electrode, electrically connected to a source of potential, such as a storage battery.

The oil burner 78 is preferably automatically controlled by a thermostatic switch element (not shown) disposed in the engine cylinder block, the switch element completing a circuit to start the oil burner when the coolant in the engine block falls below a specified temperature and shutting off the oil burner when the coolant in the engine block reaches the desired temperature. Assuming that the temperature in the engine block is below the desired temperature, the pump 88 is started and the pump then forces fuel through the fuel line 94 into the nozzle 92 from which it is sprayed into the combustion chamber 34. At the same time, the blower 84 is started and the blower forces air through the

nozzle portion 82 of the housing 80 into the combustion chamber 34 to support the combustion of the fuel. As the fuel burns, the pressure in the combustion chamber 34 rises so that the valve 64 opens and the hot gases of combustion pass through the tube 58 into the chamber 52. Portions of the gases then flow through the tube 60 while the remaining portions of the gases flow through the tube 62 into the chambers 32 and 36, respectively. As the hot gases pass through the tubes 58, 60 and 62, the heat is transferred through the walls of such tubes to the water in the tank 39. The heated water then rises and passes through the hose 54 into the cooling system of the engine while the colder water in the engine cooling system flows through the hose 56 into the lower portion of the tank 39. The thermal effect of the heated water thus causes the water to flow from the heat exchanger 38 into the engine cooling system and circulate through such cooling system to heat the engine, after which it returns to the heat exchanger through the hose 56.

At the hot gases pass into the chambers 32 and 36, respectively, they preheat the plates 28 and 30 as well as the tube 74. The fuel is ejected from the nozzle 92 into the combustion chamber under pressure and impinges on the relatively hot tube 74 and such a construction facilitates vaporization of the fuel and increases the efficiency of the combustion process.

The gases emitted into the chamber 32 through the tube 60 flow through the tube 74 into the chamber 36 and combine with the gases therein, after which all of the gases pass out of the chamber 36 into the atmosphere through the pipe 76 and the tail pipe 26.

The engine may be started relatively easily when it is desired to operate the engine since the components of the engine and the lubricants have been maintained at a relatively warm temperature during the period that the engine was inoperative and in the event the temperature of the coolant in the cooling system of the engine falls below the desired range, due to varying operating conditions, the booster heater will automatically operate to raise the temperature of the coolant. The exhaust gases from the engine enter the tubular body 10 through the exhaust pipe 18 and the tube 68 and pass into the chamber 32. The exhaust gases impinge on the plate 28 which functions as a baffle and follow a tortuous path through the chamber 32 into the tube 74. The gases then flow through the tube 74 into the chamber 36, after which the gases again follow a tortuous path through the chamber 36 and pass out of the chamber 36 through the tube 76 and the tail pipe 26 into the atmosphere. As previously mentioned, when the pressure in the chamber 52 exceeds the pressure in the combined chamber 34 the valve 64 closes, thereby preventing the exhaust gases from flowing into the combustion chamber 34. The present invention thus provides a booster heater that functions to efficiently heat the coolant of the engine and also functions as a muffler to damp the noises of the exhaust gases of the engine as the gases flow through the tubular member 10 when the engine is in operation.

While a preferred embodiment of the invention has been shown and described, it will be understood that various changes and modifications may be made without departing from the spirit of the invention.

What is claimed is:

1. A booster heater for a liquid cooled internal combustion engine comprising an elongated housing closed at each end and having a combustion chamber therein, one end portion of said housing having inlet means for receiving exhaust gases from said engine, the other end portion of said housing having outlet means open to the atmosphere, a tubular member extending through said combustion chamber and interconnecting the end portions of said housing, and heat exchange means communicating with said combustion chamber for heating the coolant of said engine.

2. A booster heater for an internal combustion engine having a liquid cooling system comprising, in combination, an elongated housing having axially disposed end chambers and a combustion chamber, one of said end chambers having inlet means for receiving exhaust gases from the engine, the other of said end chambers having outlet means open to the atmosphere, a tubular member extending through said combustion chamber and communicating with said end chambers, a heat exchanger, said heat exchanger having a fluid reservoir therein and conduit means extending through said reservoir connecting said combustion chamber with one of said end chambers, means for connecting said reservoir to the cooling system of the engine, and means for injecting fuel into said combustion chamber.

3. A booster heater for a liquid cooled internal combustion engine comprising, in combination, an elongated tubular housing having a pair of axially spaced end chambers and a combustion chamber interposed between said end chambers, one of said end chambers having inlet means for receiving exhaust gases from the engine, the other of said end chambers having outlet means open to the atmosphere, a tubular member extending through said combustion chamber axially of said housing and interconnecting said end chambers, a heat exchanger fixed to said housing and projecting outwardly therefrom, said heat exchanger including a fluid reservoir having conduit means extending there-through connecting said combustion chamber to each of said end chambers, means for connecting said reservoir to the cooling system of the engine, and means for injecting a fuel and air mixture into said combustion chamber.

4. A booster heater for a liquid cooled internal combustion engine comprising, in combination, an elongated tubular housing having a centrally disposed combustion chamber therein and a pair of end chambers on opposite sides of said combustion chamber, one of said end chambers having inlet means for receiving exhaust gases from the engine, the other of said end chambers having outlet means open to the atmosphere, a tubular member extending through said combustion chamber axially of said housing and interconnecting said end chambers, a heat exchanger fixed to said housing and projecting outwardly therefrom, said heat exchanger including a fluid reservoir having heat exchange conduit means extending therethrough connecting said combustion chamber with each of said end chambers, valve means for controlling the flow through said conduit means, means for connecting said reservoir to the cooling system of the engine, and burner means connected to said combustion chamber opposite said heat exchanger.

5. A booster heater for a liquid cooled internal

combustion engine comprising, in combination, an elongated tubular housing having a centrally disposed combustion chamber therein and a pair of end chambers on opposite sides of said combustion chamber, one of said end chambers having inlet means for receiving exhaust gases from the engine, the other of said end chambers having outlet means open to the atmosphere, a tubular member extending through said combustion chamber axially of said housing and interconnecting said end chambers, a heat exchanger fixed to said housing and projecting outwardly therefrom, said heat exchanger having a fluid reservoir therein, heat exchange conduit means extending through said reservoir and connecting said combustion chamber with each of said end chambers, check valve means preventing flow into said combustion chamber, means for connecting said reservoir to the cooling system of the engine, and means for injecting a fuel and air mixture into said combustion chamber.

6. A booster heater for an internal combustion engine of the liquid cooled type including, in combination, an elongated tubular housing having a centrally disposed combustion chamber and end chambers on opposite sides of said combustion chamber, an inlet tube extending into one of said end chambers and terminating at a position near, but spaced from, one wall of said combustion chamber, an outlet tube extending into the other of said end chambers and terminating at a position near, but spaced from, the other wall of said combustion chamber, a conduit extending through said combustion chamber and interconnecting said end chambers, the outer ends of said conduit terminating in outwardly spaced relationship with respect to the inner ends of said inlet and outlet tubes, and heat exchange means communicating with said combustion chamber for heating the coolant of said engine.

7. A booster heater for an internal combustion engine of the liquid cooled type including, in combination, an elongated tubular housing having a centrally disposed combustion chamber and end chambers on opposite sides of said combustion chamber, an inlet tube extending into one of said end chambers and terminating at a position near, but spaced from, one wall of said combustion chamber, an outlet tube extending into the other of said end chambers and terminating at a position near, but spaced from, the other wall of said combustion chamber, a conduit extending through said combustion chamber and interconnecting said end chambers, the outer ends of said conduit terminating in outwardly spaced relationship with respect to the inner ends of said inlet and outlet tubes, a heat exchanger fixed to said housing and projecting outwardly therefrom, said heat exchanger including a fluid reservoir and conduit means extending through said reservoir connecting said combustion chamber with each of said end chambers, means for connecting said reservoir to the cooling system of the engine, and means including a fuel pump and a blower for injecting a fuel and air mixture into said combustion chamber.

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